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COPY 1 OF 2

RELIABILITY ESTIMATE

PROTOTYPE EQUIPMENT TYPE 1a and 1b
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STATINTL

Prepared By

Approved By

Revision **Preliminary-A**

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2.0 GENERAL

In a series reliability configuration the probability of satisfactory performance of the system (P_s) is equal to the multiplication of the probabilities of each component in the system.

$$P_s = P_1 \cdot P_2 \cdot P_3 \cdot P_4 \cdots P_n$$

The probability of satisfactory performance of a component

$$P = e^{-\lambda t}$$

where

e = Base of Natural Log

λ = Part Failure Rate

t = Operating Time

Therefore,

$$P_s = e^{-\lambda_1 t} \cdot e^{-\lambda_2 t} \cdot e^{-\lambda_3 t} \cdots e^{-\lambda_n t}$$

$$P_s = e^{-t(\lambda_1 + \lambda_2 + \lambda_3 + \cdots + \lambda_n)}$$

$$\lambda_1 + \lambda_2 + \lambda_3 + \cdots + \lambda_n = \lambda_T \text{ (total part failure rate)}$$
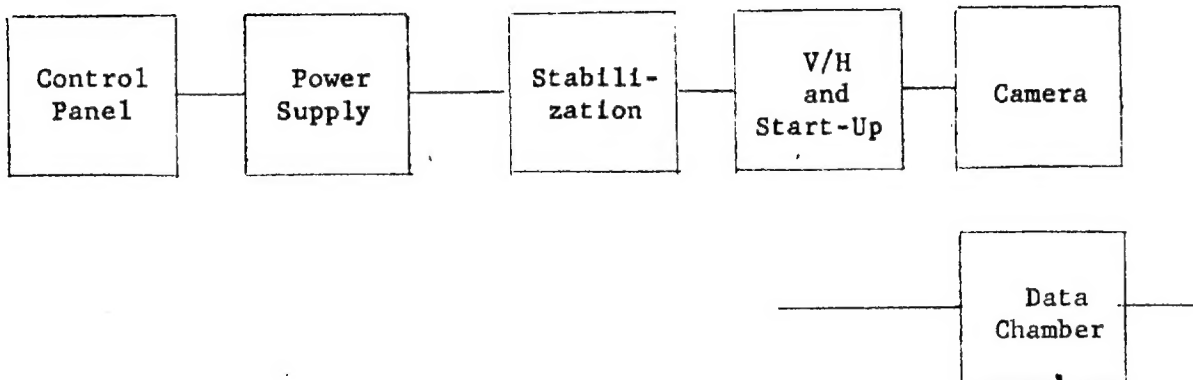
$$P_s = e^{-\lambda_T t}$$

The mean time between failure (MTBF) of a system is defined as reciprocal of the total part failure.

$$MBTF = \frac{1}{\lambda_T}$$

3.0 RELIABILITY ESTIMATE

3.1 Reliability Block Diagram

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Control Panel	Power Supply	Stabili- zation	V/H and Start-Up	Camera

Data Chamber

3.2 Calculation of Part Failure Rate

3.2.1 Control Panel

Part Name	Part Failure Rate (%/1000 Hours)
Control Panel	1.949

Total 1.949
MTBF = 51,308 Hours

3.2.2 Power Supply

Part Name	Part Failure Rate (%/1000 Hours)
A.C. Power Supply	.750
D.C. Power Supply	4.355

Total = 5.085
MTBF = 19,665 Hours

3.2.3 Stabilization

Part Name	Part Failure Rate (%/1000 Hours)
Stabilization	50.862
Roll Weight Shifter	.673
Pitch Weight Shifter	.673
Cager	.925

Total =53.133
MTBF = 1,882 Hours

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3.2.4 Camera

Part Name	Part Failure Rate (%/1000 Hours)
Supply and Tension Sensor #1	10.340
Take-Up and Tension Sensor #3	10.340
Fwd and Aft Capstan Drives	
and Tension Sensor #2	
and Metering Roller	12.752
Fwd Slit Width and Capping Shutter	2.183
Aft Slit Width and Capping Shutter	2.183
Fwd Scanner	7.415
Aft Scanner	9.989
Fwd Shuttle	10.568
Aft Shuttle	10.676
Synchronizer	13.005

Total = 89.451

MTBF = 1,118 Hours

3.2.5 V/H and Start-Up

No information available at this time.

3.2.6 Data Chamber and Timing Dots

Part Name	Part Failure Rate (%/1000 Hours)
Data Chamber	9.084
Timing Dots	1.672

Total = 10.756

MTBF = 9,297 Hours

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3.3 System Mean Time Between Failure

Control Panel MTBF = 51,308 λ = 1.949	Power Supply MTBF = 19,665 λ = 5.085	Stabili- zation MTBF = 1,882 λ = 53.133	V/H and Start-Up MTBF = λ =	Camera MTBF = 1,118 λ = 89.451

MTBF is in hours.

λ is in %/1000 hours.

Total part failure rate = 149.618%/1000 Hours.

System MTBF = 668 Hours*
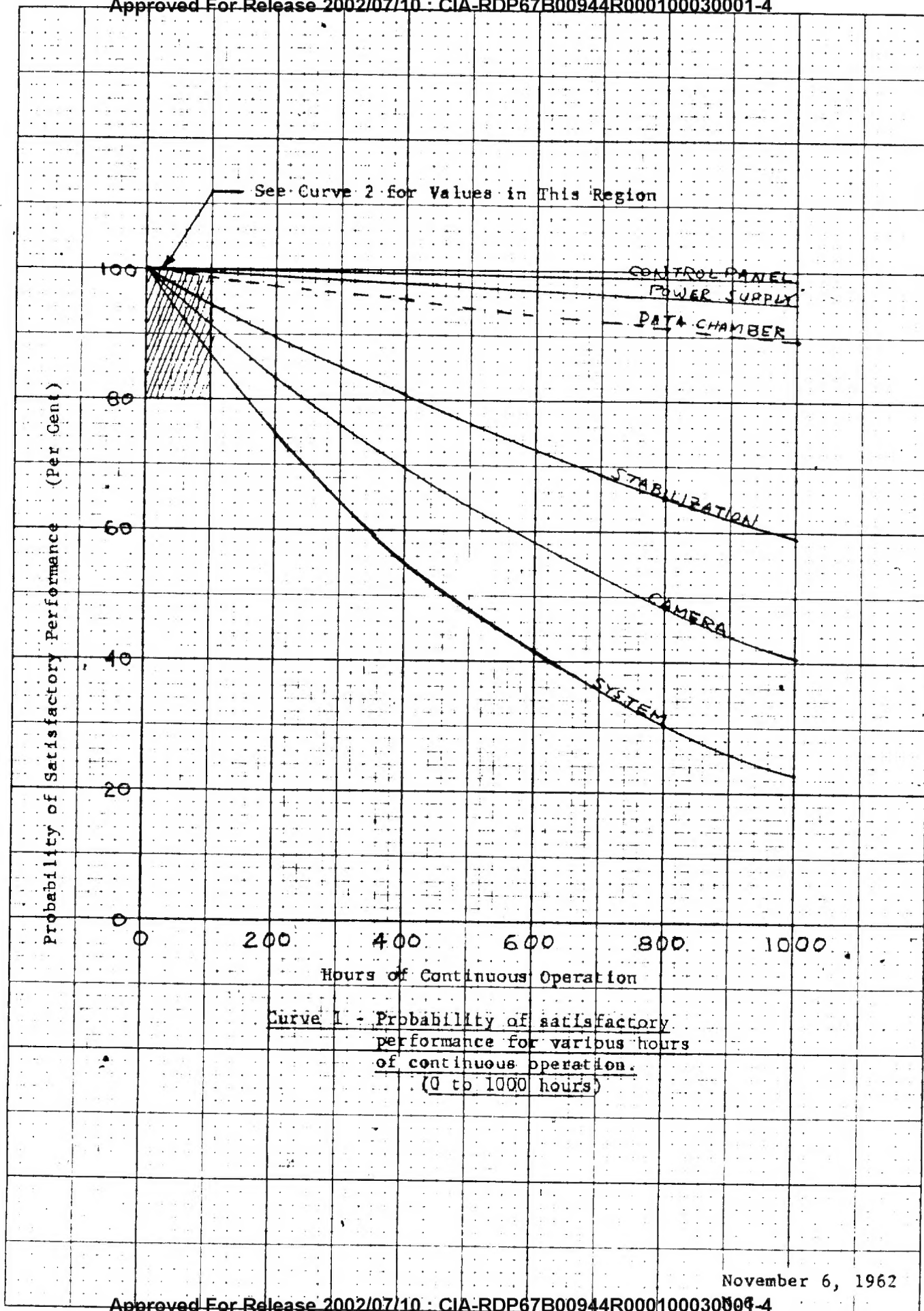
3.4 Probability of Satisfactory Performance

Curve 1 gives the probability of satisfactory performance for various operating hours from 0 to 1000 hours.

Curve 2 gives the probability of satisfactory performance for various operating hours from 0 to 100 hours.
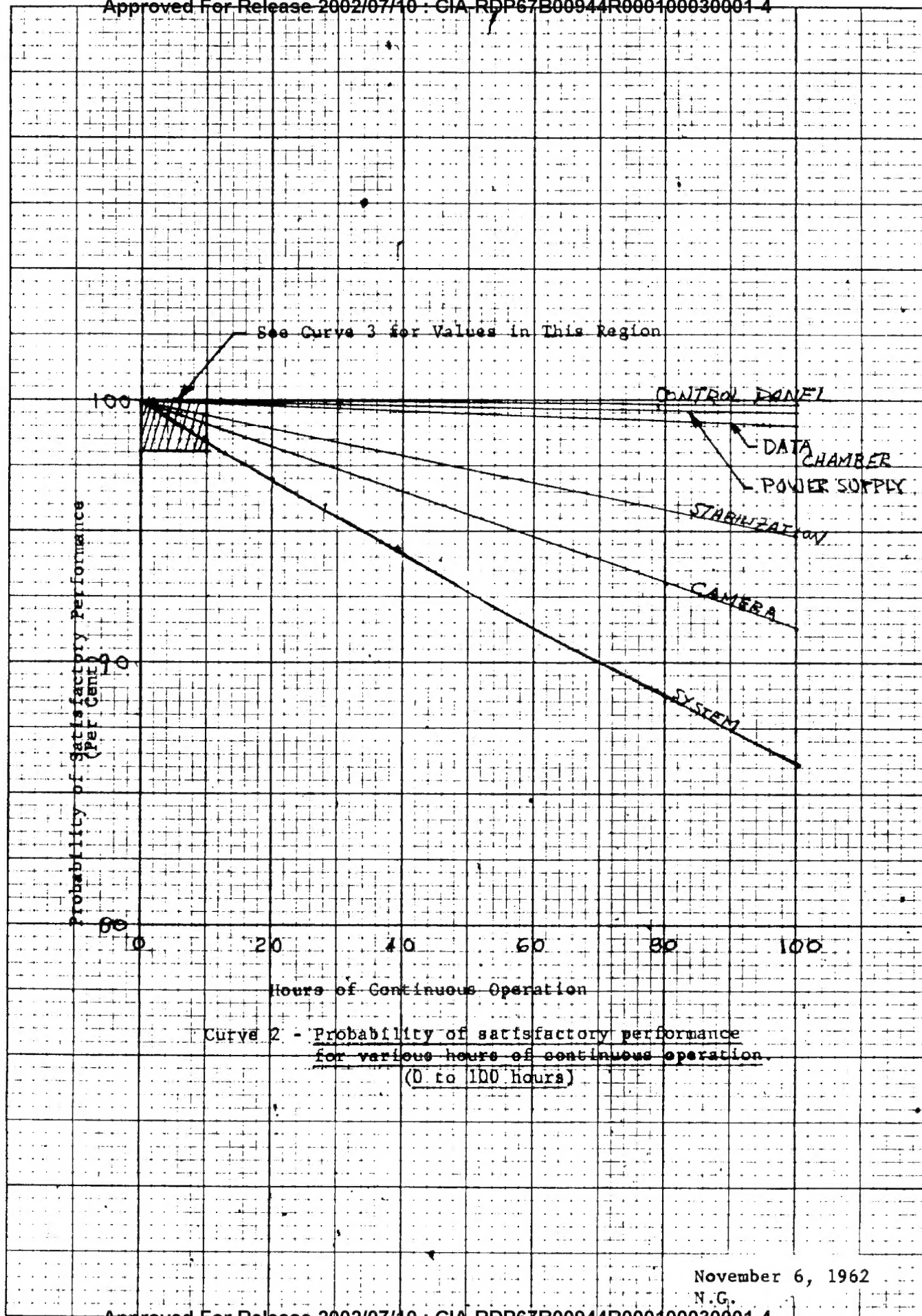
Curve 3 gives the probability of satisfactory performance for various operating hours from 0 to 10 hours.

*Excluding V/H and Start-Up

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See Curve 2 for Values in This Region

CONTROL PANEL
POWER SUPPLY
DATA CHAMBER
STABILIZATION
CAMERA
SYSTEM

Probability of Satisfactory Performance (Per Cent)

Hours of Continuous Operation

Curve 1 - Probability of satisfactory
performance for various hours
of continuous operation.
(0 to 1000 hours)

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See Curve 3 for Values in This Region

CONTROL PANEL

DATA CHAMBER

POWER SUPPLY

STABILIZATION

CAMERA

SYSTEM

Probability of Satisfactory Performance
(Per Cent)

100

90

80

10   20   40   60   80   100

Hours of Continuous Operation

Curve 2 - Probability of satisfactory performance
for various hours of continuous operation.
(0 to 100 hours)

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